



# OT B05: Site Infrastructure

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CD1 Director's Review

March 20, 2019

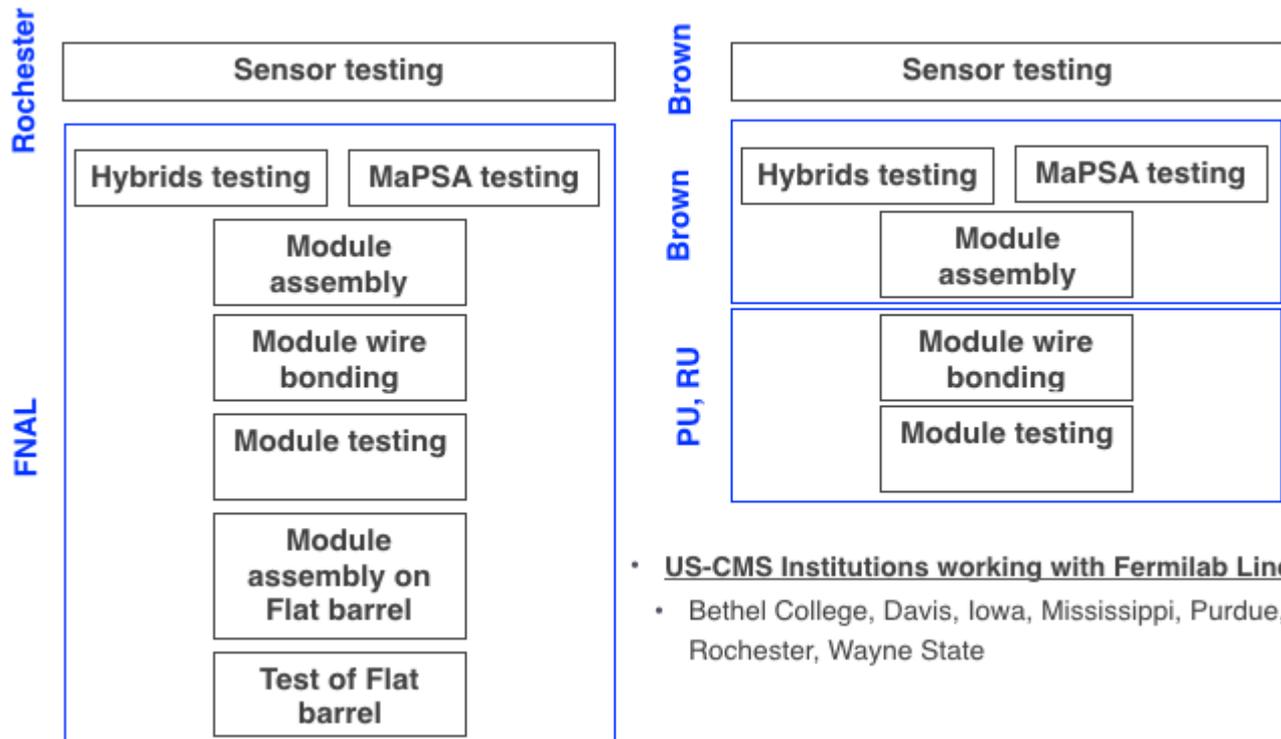




# Outline

- Introduction
- Survey of Site Infrastructure
- Summary

- Substantial Site Infrastructure needed for three tasks
  - Sensor Testing at Rochester and Brown
  - Module Assembly at Brown, Princeton, Rutgers, Fermilab
  - Flat Barrel Plank/Ring Fabrication and Loading at Fermilab

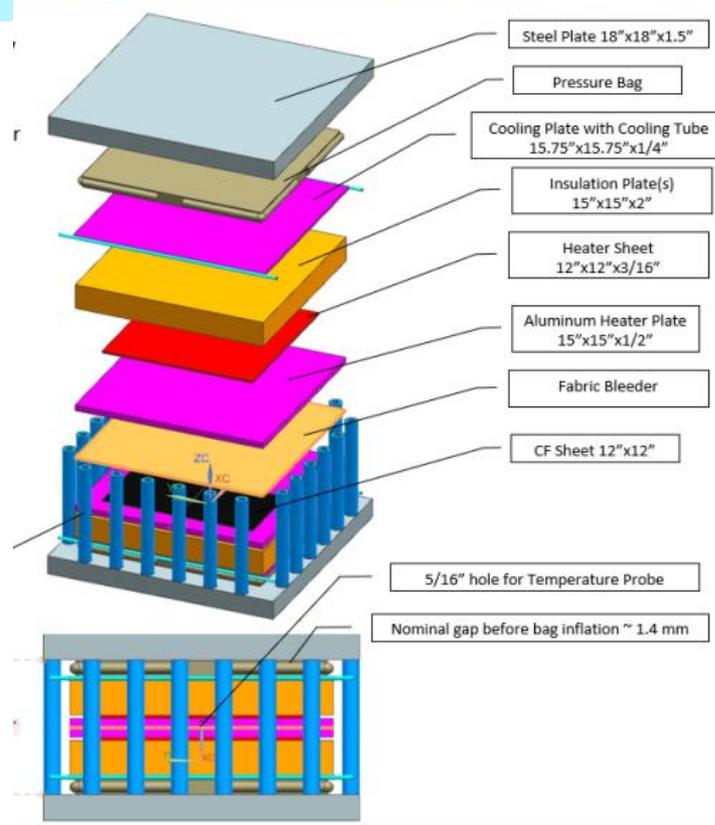


- US-CMS Institutions working with Fermilab Line
- Bethel College, Davis, Iowa, Mississippi, Purdue, Rochester, Wayne State

- Module Assembly happens at SiDet
  - Birthplace of CDF and D0 Silicon detectors, CMS Forward Pixel detectors (Phase 0 and Phase 1), Module Assembly site for CMS Tracker Outer Barrel Modules
    - Also CE cassette assembly and ETL assembly
  - Well established infrastructure, seasoned staff
    - Working with PPD to ensure succession plan



- High Pressure Curing Assembly
  - Cure at 350 °F under 30 bar
  - Recently design passed safety review



- MAB Autoclave
  - 4 ft ID, 10 ft long
  - 10 bar at 450 °F
    - Previously could do 1 bar, need 6-8

# Rochester Sensor Testing

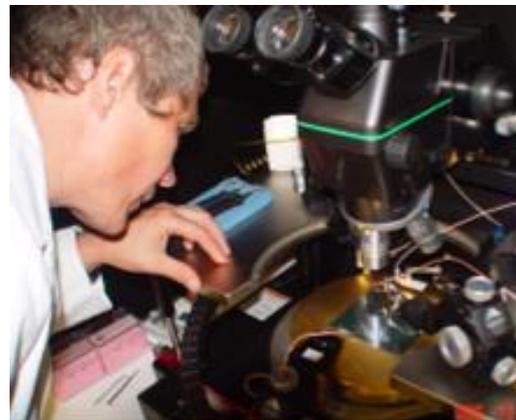
**Class 10000 clean room, set up in 2004 for “Phase0” sensor QA**

## ■ Equipment

- Semiautomatic Alessi REL-6100
- 6 positioners
- Keithley 237
- Keithley 487 (2 units)
- LCR HP4284 (2 units)
- Switch HP34970 (2 units)

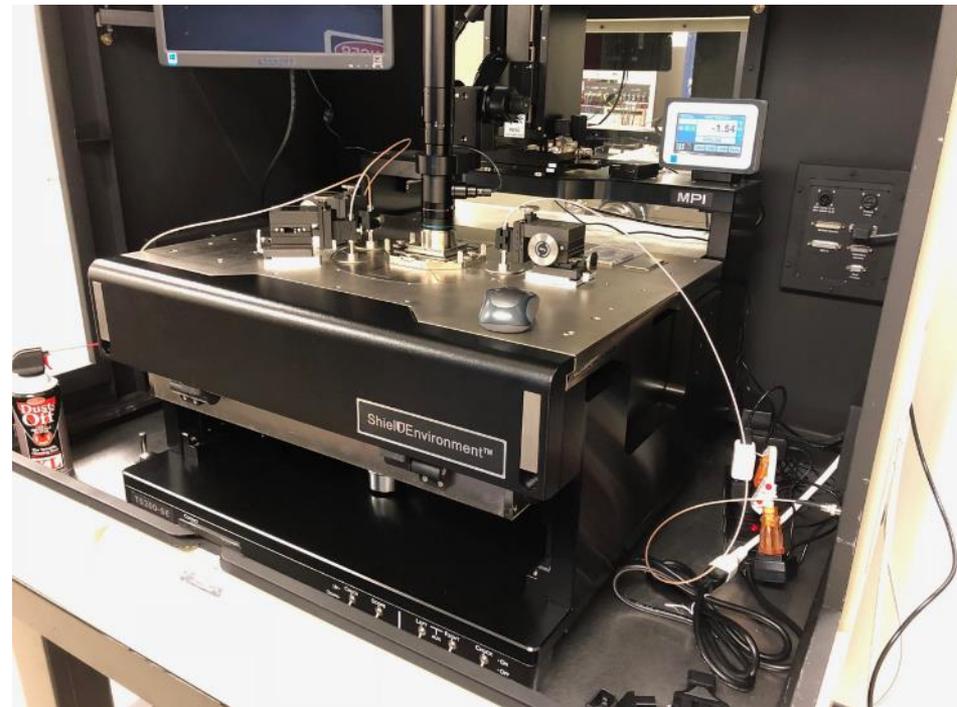
## ■ Testing durations

- CV or IV curve 10 min
- Single strip: 30 seconds
  - 106 strip 2S sensor: 8.5 hr
  - Interstrip takes longer...



# 2018 Updates at Rochester

- New probe station MPI TS200-SE 200 mm Manual Probe System with ShieldEnvironment™
  - Designed for accurate and reliable DC/CV and RF measurements at a wide temperature range (down to -10C)
  - delivered and setup May-June 2018 (8in chuck, Manual);
  - compressed dry air
  - Chiller
- Now 2 probe stations
  - Both on anti vibration tables
- Storage cabinet and the dark box are dry air purged

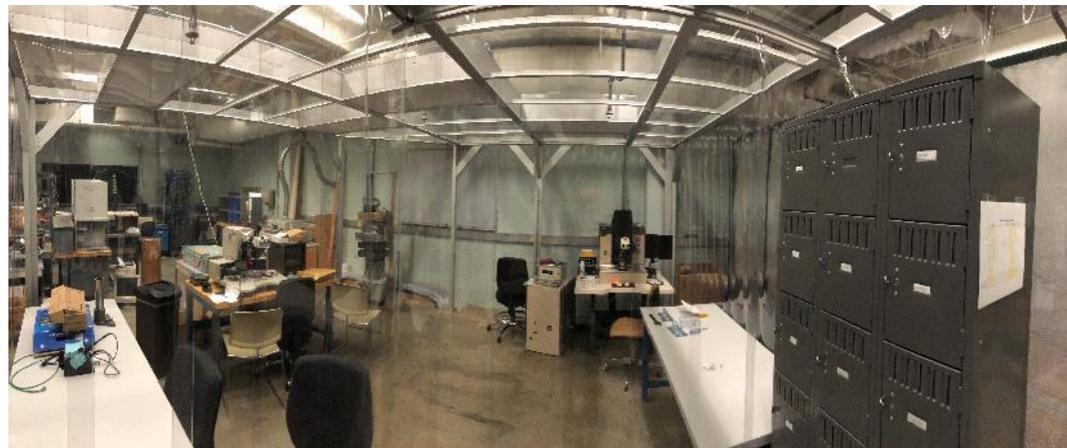


- Acquired new Cleanroom
  - Investment by university
- New equipment delivered, moved, and set up in cleanroom:
  - OGP Smartscope Flash 500
  - Nordson EFD E3V dispensing robot
  - K&S 1470 wire bonder
  - Electroglas 4090 prober
- Module assembly and Sensor testing work share this space
- Work is now taking place inside cleanroom.



# East Coast: Rutgers University

- >500 sq. ft of clean room space
  - Funded by University
- Equipment
  - KNS 1470 fully automatic wire bonder
  - KNS 4523 deep access bonder
  - WESTBOND 70PTE die bonder
  - NORDSON E2 dispensing robot
  - NICON Eclipse LV100ND microscope
  - Vacuum oven, several inspection microscopes, manual probe station
- Working with the new CMS wirebonding group to evaluate the need for a modern wirebonder (Delvotec) and pull tester



## ■ Princeton Micro Assembly Cleanroom

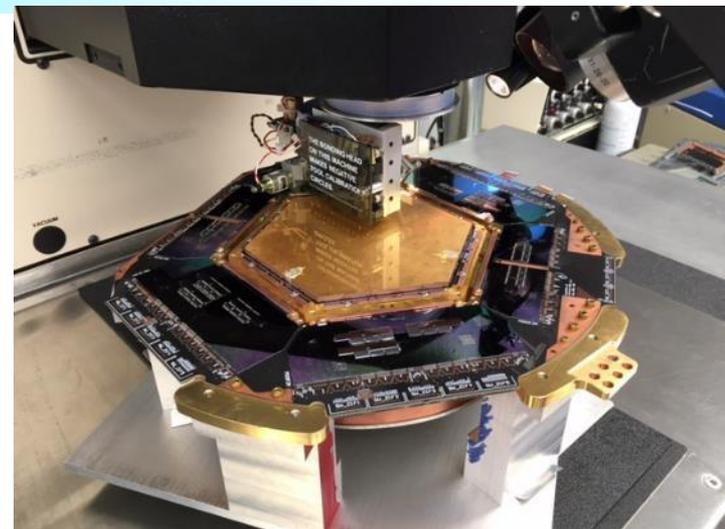


- Location: Jadwin Hall
- Room: 359
- Classification ISO-7
- FS-209 E: Class 10,000

**Overview:** The Jadwin Hall (HEP) Physics Micro Assembly Cleanroom was completed in 2018 to allow for the back end packaging of 2S & PS modules for the CMS Outer Tracker Upgrade to be performed within a clean controlled environment. Equipment in this facility primarily focuses on bonding (Die, Wire, and Epoxy).

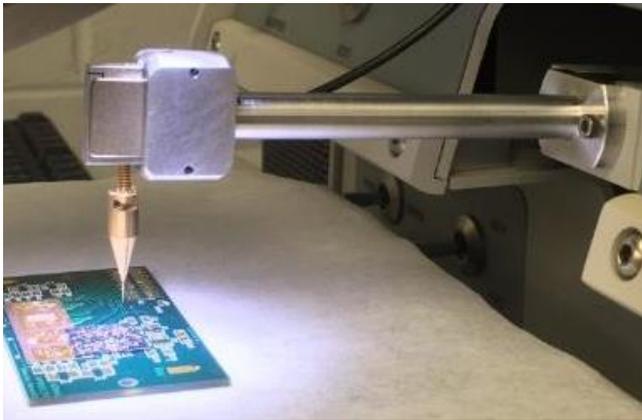
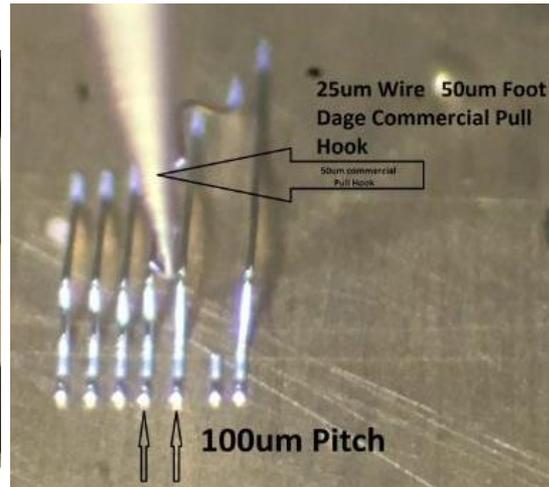
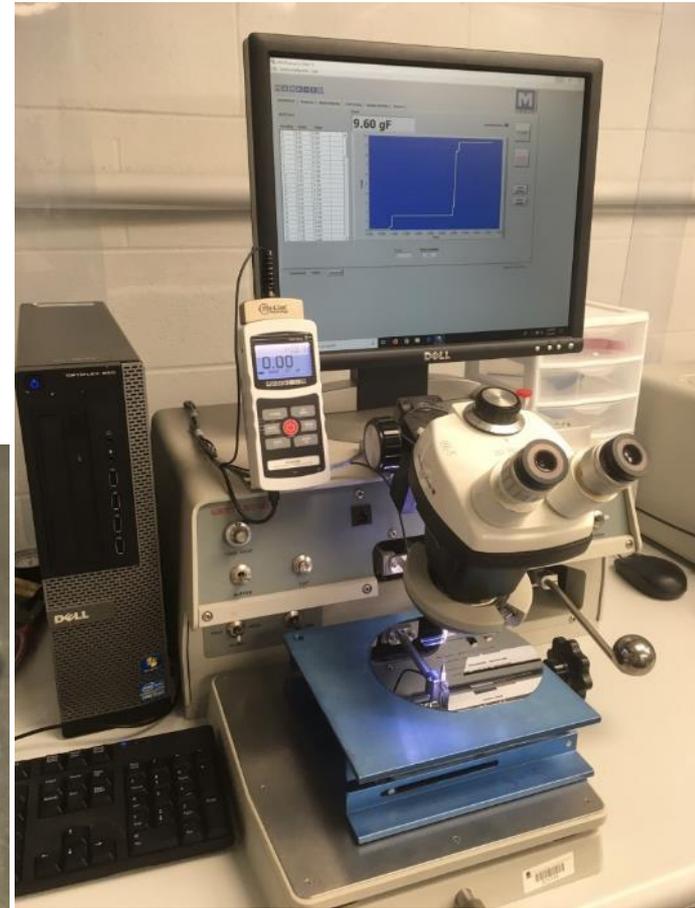
# Equipment @Princeton

- Kulicke & Soffa 1478 (Fully Automatic Large Area Wedge Bonder)
- Encapsulation: Nordsen EV (3-Axis EV Series Automated Dispensing System)
- Vacuum Mixer (Smartmix X2)
- Jelight UV Ozone Cleaner (Model 144AX)



# Home Brew Pull Tester @Princeton

- Built on a West Bond 7476 Chassis
  - Manual ~1-2 seconds per/wire Operator Dependent
- Bausch & Lomb Microscope
  - Fine Articulation
- Mark-10 Digital Indicator with (0-100)Gram Force Sensor
  - 50um hook
  - 7,000 Hz Sampling Rate
  - PC data via USB
  - Accuracy  $\pm 0.1\%$  of full scale or  $\pm 0.1$  grams





# Sundry information

## ■ Remaining issues

- Few final procurements not yet complete
- May need to update wirebonder at Rutgers/Princeton
  - Wire bonds are long and shallow, high propensity for wayward bonds
  - Hybrid substrate not fully determined – hard/softness may limit bonding equipment
  - Wirebond taskforce led by L. Spiegel to suss out these issues for all CMS assembly sites

## ■ Visits

- Have informally visited Brown, Rutgers, and Princeton sites during project workshops
- ESH&Q officers and L2 team foresee formal audit of site readiness before pre-production activities commence
  - Audit checklist and report template: [cms-docdb-13668](#)